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ABSTRACT

A study investigated the effects of text condensation, field independence, and sex on students' comprehension of and attitudes toward instructional prose materials. Fifty-eight high school juniors and seniors were divided into three groups on the basis of sex and their scores on a field independence measure. Students in the original treatment were given an original version of a chapter from a standard psychology textbook, which contained a summary. Students in the abridged treatment were given an abridged version of the same chapter, and students in the control group were given a posttest without receiving any instruction and were then given the abridged chapter to read. The results showed that condensing the chapter improved the short-term recall of information incidental to the summary ideas. Condensation also improved learning efficiency (the test score divided by time spent). A delayed posttest administered two weeks after the experiment and the results of an affective questionnaire showed no treatment differences in student attitudes toward the reading material. Field independent students were moderately more successful than field dependent students in answering application level questions, and males answered incidental questions better and spent more time studying the reading materials than did females. (Author/FL)

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Effects of Text Condensation, Field Independence, and Sex on Comprehension of Prose Material

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Effects of Text Condensation, Field Independence, and Sex on Comprehension of Prose Material

Merrill and Wood (1976) developed a taxonomy of instructional variables which divides instructional content into four primary presentation forms. One form, an expository generality, is a descriptive statement which does one of three things: first, it may identify critical attributes of a concept and indicate how these attributes are combined; second, it may specify various interrelationships between concepts; and third, it may present procedures for ordering and using concepts.

A second primary presentation form, an expository instance, is a particular object, event, or symbol which is an example of a concept, a relationship between concepts, or a procedure for using concepts (Merrill and Wood, 1976).

In an experiment conducted by Wilcox, McLachlan, and Merrill (Note 1), one treatment consisted of an original chapter from a psychology textbook. Another treatment was an abridged version of this same chapter in which transition sentences, restatements of expository generalities, and some subordinate information contained in the expository instances were removed. The abridged chapter produced the same test performance as the original chapter, but students spent considerably less time studying the abridged chapter.

The test used in the Wilcox et al. (Note 1) study was composed of memory and application level items that were relevant to the expository generalities. However, information incidental to the expository generalities was not tested. This was unfortunate because students given the abridged chapter may have had better recall of the incidental information contained in the expository instances than students given the original chapter. There are two reasons why the abridged chapter was thought to facilitate recall of incidental information. First, Kintsch (1976) found that superordinate ideas in text material are usually recalled better than subordinate ideas. This suggests that information in expository generalities more likely would be recalled than information in expository instances. Thus, if there were learning differences caused by the treatments in the Wilcox et al. (Note 1) study, these differences probably would be more apparent with subordinate information in the expository instances than with superordinate information in the expository generalities. Second, because transition sentences and some of the most irrelevant information in the expository instances were removed from the abridged chapter, there would be less memory load for incidental information in the abridged chapter than in the original chapter.

Witkin, Moore, Goodenough, and Cox (1977) indicated that field dependent persons tend to have difficulty in taking critical elements of a problem out of the context in which they are presented and restructuring the problem material so that the elements are used in a different context. Because application level test questions require students to apply concepts to unencountered instances, it was hypothesized that field independent students would score better on application level test items than field dependent students.

In the Wilcox et al. (Note 1) study, a sex x treatment interaction was observed. Males exposed to the original chapter had higher test scores than males exposed to the abridged chapter. There were only slight differences between the two treatments for female test scores. Also, there were no main effects for sex on test scores.

The purpose of this experiment was to test the effects of text condensation, field independence, and sex on the comprehension of and attitude toward prose material. Specifically, the research issues of interest included:

1. Whether the abridged chapter would result in better recall of incidental information and, consequently, a more positive attitude toward the text material than the original chapter;
2. Whether field independent students would perform

better on application test items than field dependent students;

3. Whether a similar sex x treatment interaction as in the Wilcox et al. (Note 1) study would happen with high school students instead of college introductory psychology students;
4. Whether a lack of treatment differences for generality-relevant test items on an immediate posttest would occur with high school students as it did with college undergraduates in the Wilcox et al. (Note 1) study; and
5. What long-term (after two weeks) learning effects would be produced.

Method

Students

Fifty-eight high school students (34 seniors and 24 juniors) participated in this study. All of the students were enrolled in one of two psychology classes at Provo High School.

Materials

Field independence. The Hidden Figures Test (HFT) from the Kit of Reference Tests for Cognitive Factors (French, Ekstrom, and Price, 1963) was used to measure student field

independence. This test has been shown to correlate highly (r=.62) with Witkin's Embedded Figures Test (Jackson, Messick, & Meyers, 1964).

Treatments. Two types of instructional booklets prepared for the Wilcox et al. (Note 1) experiment also were used in this study. One booklet comprised the second chapter of Elementary Principles of Behavior (Whaley, & Malott, 1971), a best selling psychology textbook covering such topics as operant conditioning, reinforcement, and response classes. The chapter included a summary section which listed important generalities. The other booklet was an abridged version of the same chapter. It was composed of six expository generalities, each of which was followed by at least one expository instance. Generalities in the abridged booklets were nearly the same as the summary points (generalities) at the conclusion of the original chapter. Each generality in the abridged booklet was placed in a box atop a different page with a meaningful label above it. Below the box was another label which identified and preceeded one or more examples of the generality. These examples sometimes were made shorter than they appeared in the original chapter. When such editing took place, only unnecessary information was deleted. In the case of the first generality of the abridged booklets, there was one nonexample. It was

labeled by a phrase indicating that it was not an example of the concept being taught.

The fourth page of the abridged booklet showing the third generality, its labels, and instances is reproduced in Figure 1.

Insert Figure 1 about here

Tests. Three sets of twelve five-alternative, multiple-choice test items were prepared. Two of these sets of items were based on the expository generalities specified in the summary of the original chapter. Questions in one of the generality based sets of items were at an application level, and questions in the other generality based set were at either a verbatim or nonverbatim memory level. The third set of test items was based on incidental information contained in the expository instances. These incidental questions were all at the verbatim memory level. Figure 2 shows one of the application items, Figure 3 one of the generality based memory items, and Figure 4 one of the incidental test items.

Insert Figures 2, 3, and 4 about here

From the three sets of test items, two posttests were formed. The immediate posttest included eight questions from each of the three sets. The delayed posttest included four questions from each of the three sets. Order of questions in both posttests was randomized. Reliability of

the immediate and delayed posttests was estimated to be .73 and .26 respectively by using the Kuder-Richardson Formula 21.

Affective questionnaire. An affective questionnaire with nine five-point rating scales and two questions was constructed. Characteristics of the reading material that were measured by the scales included interest, excitement, humor, style, length, organization, readability, clarity, and overall appeal. One question asked whether main ideas were easy to pick out. The other question asked how many textbooks the student would want to be organized like the reading material in the experiment.

Procedure

Students were divided into one of four groups on the basis of sex and HFT score. There were 15 males and 20 females who scored above the median on the HFT while 11 males and 25 females scored below the median. Members of each of these groups then were randomly assigned to one of three treatment conditions. Students assigned to the original treatment were given the original chapter. Students assigned to the abridged treatment were given the abridged chapter. Students assigned to the control treatment were given the immediate posttest without receiving any instruction. After

taking the posttest, control group students were supplied with the abridged chapter. On the day following the experiment, students responded to the affective questionnaires. Two weeks later, the delayed posttest was administered.

Instructional booklet directions asked the students in the original and abridged treatments to study the entire booklet for as long as desired, to mark the beginning and ending times to the nearest minute in the proper blanks by referring to the clock in the room and to go on to the test booklet when they were finished. It also explained that the content would be tested.

The test booklet directions asked students to circle the response which they thought was most correct from one of the five possible responses for each item. Students also were directed to take as long as they wanted to record starting and ending times and to not look at the instructional booklets during the immediate posttest.

Results

Of the 71 students who completed the HFT and were assigned to treatments, two field independent males, one field independent female, two field dependent males, and eight field dependent females were not used in this study because they were absent on the day of the experiment,

on the day following the experiment, or on the day of the delayed posttest.

A one-way ANOVA with planned orthogonal contracts was performed for each dependent variable. The contrasts compared the two instructed treatments with the noninstructed control treatment and the original treatment with the abridged treatment.

Main Effects

Treatment differences. Table 1 reports the means and and standard deviations of those dependent variables on which there were significant treatment differences.

On the immediate posttest, there were no significant treatment differences for application items. For generality based memory items, the instructed groups scored higher than the control group $F=4.70$ (1, 46), $p<.036$. Also, when application and memory scores were combined, the instructed groups did better than the control group, $F=5.90$ (1, 46), $p<.019$. For incidental items, not only did the instructed groups perform better than the noninstructed group, $F=116.16$ (1, 46), $p<.001$, but the abridged group scored higher than the original group, $F=19.06$ (1, 46), $p<.001$. When application, memory, and incidental scores were added together, the instructed groups achieved better than the control group, $F=32.46$ (1, 46), $p<.001$, and the abridged group was superior to the original group, $F=6.59$ (1, 46), $p<.015$.

Insert Table 1 about here

On the delayed posttest, there were no significant treatment differences. However, when incidental scores from both posttests were combined, the abridged group scored higher than the original group, $F=9.21$ (1, 46), $p<.004$. Also, when the total scores of both posttests were added together, the abridged group achieved better than the original group, $F=4.50$ (1, 46), $p<.035$.

The abridged group took much less time to study the reading material than the original group, $F=200.49$ (1, 46), $p<.001$. But, there were no significant treatment differences for time spent on either posttest. When the study and test times were combined into an overall time for each student, the abridged group spent less time than the original group, $F=30.6$ (1, 46), $p<.001$.

Four types of efficiency scores were computed. Efficiency scores of the first type (Efficiency I) were calculated by taking the logarithm of one added to the ratio of the combined immediate and delayed posttest application plus memory scores to the study time for each student. Efficiency scores of the second type (Efficiency II) were calculated by taking the logarithm of one added to the ratio of the combined immediate and delayed posttest application plus memory scores to the overall time for each

student. Efficiency scores of the third type (Efficiency III) were calculated by taking the logarithm of one added to the ratio of the combined totals of both posttests to the study time for each student. Finally, efficiency scores of the fourth type (Efficiency IV) were calculated by taking the logarithm of one added to the ratio of the combined totals of both posttests to the overall time for each student. The logarithm transformation was used to compress the distribution of efficiency scores so that spurious results would be less likely.

The abridged group was more efficient than the original group for each type of efficiency: Efficiency I, $F=55.95$ (1, 46), $p<.001$; Efficiency II, $F=6.93$ (1, 46), $p<.012$; Efficiency III, $F=117.03$ (1, 46), $p<.001$; and Efficiency IV, $F=18.78$ (1, 46), $p<.001$.

The only significant treatment differences on the questionnaire items involved the ratings of the humor and length scales. The original group thought the reading material was more humorous than the abridged group, $F=5.7$ (1, 46), $p<.021$. But the abridged group thought that the reading material was of better length than the original group who judged the reading as being too long, $F=6.27$ (1, 46), $p<.016$.

Field independence difference. The only significant field independence difference appeared when the application scores of the immediate and delayed posttests were combined into one score for each student. The 32 field independent students scored higher on these combined application scores (M=5.06, SD=.362) than the 26 field dependent students (M=3.84, SD=.419), F=4.85 (1, 46), p<.033.

Sex differences. Table 2 reports the means and standard deviations of those dependent variables on which there were significant sex differences.

On the delayed posttest, males answered incidental items better than females, F=5.99 (1, 46), p<.018.

Males studied the reading material longer than females, F=7.61 (1, 46), p<.008. Males also spent longer on the delayed posttest than females, F=6.46 (1, 46), p<.014. When all times were combined, the overall times for males exceeded the overall times for females, F=6.58 (1, 46), p<.014.

Insert Table 2 about here

Interactions

Field independence x treatment interactions. There were two significant interactions between field independence and the treatments. One of these interactions involved the times spent on the immediate posttest, F=4.37 (1, 46), p<.042. Table 3 shows the means and standard deviations

of this interaction. The other interaction occurred with the ratings on the clarity scale of the questionnaire, $F=4.64$ (1, 46), $p<.036$. The means and standard deviations of this second interaction are reported in Table 4.

Insert Tables 3 and 4 about here

Sex x treatment interactions. Four significant sex x treatment interactions were found. One of these interactions was with the immediate incidental item scores, $F=7.61$ (1, 46), $p<.008$. An almost identical interaction involved the combined immediate and delayed posttest incidental item scores, $F=6.82$ (1, 46), $p<.012$. Table 5 displays the means and standard deviations of these first two interactions. A third interaction happened with times spent studying the reading material, $F=23.70$ (1, 46), $p<.001$. A similar interaction was obtained with overall times, $F=7.52$ (1, 46), $p<.009$. The means and standard deviations of these last two interactions appear in Table 6.

Insert Tables 5 and 6 about here

Field independence x sex interaction. One significant interaction between field independence and sex was observed, $F=4.86$ (1, 46), $p<.033$. Table 7 shows the means and standard deviations of this interaction.

Insert Table 7 about here

Field independence x sex x treatment interactions. There were two significant three-way interactions involving study and overall times. However, the means and standard deviations of these interactions probably were not reliable because they were obtained from very small sample sizes.

Discussion

Issue one. Removing transition sentences and unnecessary subordinate information from the original chapter facilitated recall of remaining incidental information. But, this improved incidental learning did not noticeably affect student attitudes toward the text. On only one scale of the questionnaire did the abridged chapter produce a more positive rating than the original chapter.

Issue two. Field independent students were moderately more successful than field dependent students in answering application level questions. Application test scores for field independent students were not significantly better than application scores for field dependent students on either of the posttests. Only when application scores on both posttests were combined for each student did the relative superiority of field independent students in responding to application items become significant.

Issue three. The sex x treatment interaction found in the Wilcox et al. (Note 1) study did not occur in this experiment. However, two other sex x treatment interactions were observed. Males performed equally well on incidental test items regardless of the type of chapter they were given. On the other hand, females scored somewhat better than males on incidental items when they were supplied with the abridged chapter. But, females did very poorly on incidental items when they received the original chapter. Females also spent less time studying the original chapter than males.

The failure to replicate the sex x treatment interaction described in the Wilcox et al. (Note 1) study probably was the consequence of the high school population sampled in this experiment. As yet, the authors cannot offer an adequate explanation for the sex x treatment interactions produced by either of these experiments.

A sex difference not found by the Wilcox et al. (Note 1) study occurred in this experiment. Males spent longer studying the reading material than females. Maybe this is because females generally have better verbal skills than males. Males also scored better than females on the delayed posttest incidental items. This may have resulted from the longer male study times.

Issue four. Just as in the Wilcox et al. (Note 1) study, text condensation did not appreciably increase performance on generality based test items in the immediate posttest. Delayed posttest scores for generality based items also were not improved by the abridged chapter.

Issue five. Although short-term incidental learning was benefited by the text abridgement, long-term incidental learning remained unaffected. Perhaps, the lack of differences on the delayed posttest was partially the result of its low reliability (r_{KR21}=.26). But, it is possible that no long-term learning of any kind occurred because the delayed posttest mean score ($\underline{M}$=4.15) only exceeded the delayed posttest chance score by a mere 1.75 points. Unfortunately, control group data was not collected for the delayed posttest so that this hypothesis could be tested.

Unexpected interactions. There is evidence that increased structuring of instructional materials aids field dependent students more than field independent students (Witkin et al., 1977). The abridged chapter consistently was structured in such a way that each generality was followed by instances of that generality. This might help to explain why field dependent students thought the abridged chapter was clearer than the original chapter. Why field independent students felt that the original chapter

was clearer than the abridged chapter, however, is still a mystery to the authors. This interaction of field independence and type of chapter on the perceived clarity of the instruction may have given rise to the similar field independence x type of chapter interaction on the times to complete the immediate posttest.

The authors do not have a suitable explanation for the field independence x sex interaction on scores for incidental items in the immediate posttest.

Conclusion. On the basis of the greater learning efficiency and short-term incidental learning brought about by the abridged chapter, this experiment provides some evidence in favor of the proposition that instructional prose should be condensed by preserving only the most important expository generalities and essential portions of expository instances of those generalities.

Reference Note

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Table 1

Means and Standard Deviations of Dependent Variables Exhibiting Treatment Differences

Dependent variable	Treatment group		
	Abridged n=21	Original n=15	Control n=22
Immediate posttest memory	3.06 (.395)	2.50 (.465)	1.70 (.390)
Immediate posttest application & memory	6.26 (.608)	5.04 (.715)	3.80 (.600)
Immediate posttest incidental	6.22 (.255)	4.50 (.300)	1.91 (.252)
Immediate posttest total	12.48 (.742)	9.54 (.873)	5.72 (.732)
Immediate & delayed posttests incidental	7.59 (.356)	5.92 (.419)	---
Immediate & delayed posttests total	16.67 (.985)	13.37 (1.16)	---
Study time	13.58 (.636)	27.50 (.749)	---
Overall time	35.51 (1.40)	47.46 (1.64)	---
Efficiency I	.2194 (.0099)	.1052 (.0116)	---
Efficiency II	.0989 (.0086)	.0639 (.0101)	---
Efficiency III	.3498 (.0106)	.1722 (.0125)	---
Efficiency IV	.1685 (.0091)	.1075 (.0107)	---
Humor	2.07 (.173)	2.71 (.204)	---
Length	4.61 (.202)	3.83 (.238)	---

Table 2

Means and Standard Deviations of Dependent Variables Exhibiting Sex Differences

Dependent variable	Males n=22	Females n=36
Delayed posttest incidental	1.77 (.229)	1.05 (.182)
Study time	14.77 (.608)	12.62 (.484)
Time on delayed posttest	7.63 (.426)	6.25 (.339)
Overall time	37.22 (1.34)	32.84 (1.06)

Table 3

Means and Standard Deviations of Times On Immediate Posttest

	Treatment group	
Field independence	Abridged	Original
Field independents	13.15 (1.06) n=11	14.08 (1.23) n=9
Field dependents	16.24 (1.20) n=10	12.00 (1.43) n=6

Table 4

Means and Standard Deviations of Ratings

On Clarity Scale of Questionnaire

	Treatment group	
Field independence	Abridged	Original
Field independents	3.33 (.269) n=11	4.00 (.314) n=9
Field dependents	4.02 (.307) n=10	3.33 (.363) n=6

Table 5

Means and Standard Deviations of Scores

For Incidental Test Items

Sex	Treatment group	
	Abridged	Original
	Immediate posttest	
Males	5.80 (.406) $\bar{n}$= 8	5.17 (.454) $\bar{n}$=6
Females	6.64 (.309) $\bar{n}$=13	3.83 (.393) $\bar{n}$=9
	Immediate plus delayed posttests	
Males	7.23 (.567)	7.00 (.634)
Females	7.94 (.432)	4.83 (.549)

Table 6

Means and Standard Deviations of Times

Sex	Treatment group	
	Abridged	Original
	Study times	
Males	12.80 (1.01) n= 8	31.50 (1.13) n=6
Females	14.37 (.771) n=13	23.50 (.980) n=9
	Overall times	
Males	35.13 (2.22)	53.00 (2.49)
Females	35.89 (1.69)	41.92 (2.15)

Table 7

Means and Standard Deviations of Scores For Incidental Items on Immediate Posttest

	Sex	
Field independence	Males	Females
Field independents	4.02 (.318) n=13	4.56 (.256) n=19
Field dependents	4.56 (.371) n= 9	3.71 (.292) n=17

Figure Captions

Figure 1. Fourth page of abridged booklet.

Figure 2. One of the application level test items.

Figure 3. One of the generality based memory level test items.

Figure 4. One of the incidental test items.

RULE 3 (Associating the reinforcer with the behavior)

> For conditioning to occur, the potential reinforcer must be closely associated with the behavior that is to be increased. Optimum conditioning takes place when the potential reinforcer is presented immediately after the behavior to be conditioned has been exhibited.

EXAMPLES of associating reinforcers with behaviors

Example 1

A research study conducted in 1964 employed three groups of ten infants each. Every baby in the first group was given a bottle of milk immediately after he turned his head to the right. The second group was treated in the same manner except that turning the head to the left produced the milk bottle. Babies in the third group were given bottles on a random schedule with complete disregard for head-turning behavior.

The results showed that the milk served as a positive reinforcer for the first two groups. But, milk presentations failed to condition head-turning behavior in the random-presentation group.

Example 2

A nine-year-old boy named John was brought to the Human Development Clinic at Florida State University by his mother who complained that he never heeded her when she attempted to call him in from play. She came to the clinic seeking a means of controlling her

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What is the positive reinforcer in each of these three passages?

Passage 1

The family was delighted with their newly acquired dog named Caesar. He performed numerous tricks such as rolling over, jumping, playing dead, and barking. All family members had to do was provide the appropriate signals and commands. It was decided that Caesar should be rewarded when he did a trick. After all, he did them so well. Each time Caesar completed a trick, he was given his favorite ball to play with. Of course, Caesar still faithfully performed the tricks as he had always done.

15. a. favorite ball
    b. signals
    c. food
    d. pats on the head
    e. there is no positive reinforcement

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3. Which is the best description of an abscissa?

   a. horizontal axis of a graph

   b. vertical axis of a graph

   c. frequency of response

   d. time period

   e. cumulative record

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What reward did the explorer receive for his heroic deed?

a. plump and giddy daughter of the chief.
b. one of the chief's wives.
c. feast of the natives' favorite foods.
d. gold piece worth $50.
e. sweetened and warmed milk.

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